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ABSTRACT

Outlined are preliminary findings from a study of computer use by Australian preschool children. Subjects were 90 children of 4 years who were enrolled in four Sydney preschool classes. A computer was set up in a learning center and was available to the children during free play sessions. Children's behaviors were observed and recorded as the children used a drawing program and a single key stroke version of Logo with a floor "turtle." Observations took place over a 5- to 6-week period. Reported results focus on: (1) computing knowledge, attitudes, and experience; (2) expressed play preferences; (3) frequency and duration of computer play; and (4) play style in the computer area. Findings suggest that 4-year-old children may already be seeing the use of computers in society and the classroom as a male-oriented activity. The possible sex typing of computing and computer-based activities at such an early age has several implications that are related to the development of differential skills, attitudes, outlooks, and future goals. It is concluded that early childhood educators need to take action to encourage more gender equitable participation and experience in computer use. (RH)

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PROJECT REPORT A working paper

Sex typing of young children's behaviours in a computer active preschool classroom

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Abstract

The purpose of this presentation is to outline some **preliminary** findings from a study of preschoolers' computer use that relate to gender differences in computing knowledge, experience and attitudes, and participation in computer activities. The findings are of interest and concern as they suggest that four year old girls and boys may already be seeing the use of computers in society and the classroom as a male oriented activity. The possible sex typing of computing and computer based activities at such an early age has several important implications that relate to the development of differential skills, attitudes, outlooks and future goals. For early childhood educators the need to take action to encourage more gender equitable participation and experience in computer use would seem to be an essential requirement of curriculum planning and practice.

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Introduction

Although computer based learning has been a feature of schooling for a relatively short time, a time when teachers, educational policy makers, and the community at large are supposedly sensitive to gender based differentiation and discrimination in schooling, it seems that computers, and many aspects of computing, tend to be viewed as male oriented. A consistent finding from studies of computer use amongst children is that boys have more access to computers and use them more frequently and with more control than do girls (Clements, 1987). If this persists it seems likely that the disadvantages traditionally experienced by girls in relation to mathematics and science may be extended to experiences with computers and related technologies (Clarke, 1986; Fitzgerald et al., 1986; Krystyn, 1987; Rosier and Payne, 1986; Schubert, 1986; Smail, 1985).

The penetration of computer based learning experiences in Australian preschools has been much slower than at other levels of education. Gradually though, early childhood teachers are becoming interested in the possibility of adding computer based learning experiences to the range of more traditional activities already offered in their centres (Elliott, 1987). In view of a general concern for providing sex equitable learning environments for young children it seems essential to ensure that both girls and boys have equitable and positive experiences with developmentally appropriate computer based learning activities.

Gender issues in preschools

Issues relating to gender and equity in curricula have long been of concern to early childhood educators. There is a substantial body of literature focussing on sex differences in children's play and an equally substantial array of literature which presents strategies for overcoming sex typing and creating more gender equitable learning environments for young children. However, the degree to which classroom teachers recognise the occurrence or impact of sex typing or actively structure their curricula to make it more gender equitable varies from setting to setting.

A fruitful area of investigation into children's play concerns the influence of local environmental variables on playstyle. Findings from studies that suggest that teachers exercise considerable control in the creation of play environments that generate certain playstyles is particularly interesting in terms of a computer active preschool classroom (Pellegrini, 1985; Quilitch and Rislev, 1973; Harper and Sanders, 1976). Will the computer, with its capacity to take on a variety of characters by virtue of

its software, evoke play behaviours similar to those in more traditional play settings? In what ways does the nature and content of computer based activities, many of which are largely independent of the technology, encourage particular play behaviours?

That young children best explore their world through play is widely acknowledged and provides the theoretical basis upon which preschool curricula have usually been developed. In their play children utilise aspects of the contemporary technologies of the societies in which they live. Nowhere is this more clearly illustrated than in the typical Australian preschool classroom, where some children might be engaged in play that involves cooking on a stove, listening to a patient's heart beat, typing a letter on a typewriter, talking on the telephone, using a cash register, drying a dolls hair with a hairdryer, or building with wood, saw, hammer and nails. Other children might be playing musical instruments, building a rocket launching pad or a high rise car park, digging a canal, or firing a laser gun. Children's play is a reflection of, contributor to, and part of life. What ever their play, it is not uncommon for children to use real world objects or representations of them to explore their environment. In this way they are using the technologies available in a given society. If one accepts this position then a computer in the classroom can complement the range of "real world" technologies available for children's use. There is no reason to suggest that playstyle in the computer area, providing the computer based activities are developmentally appropriate, should be vastly different from playstyle in other areas with similar learning goals.

Why the concern?

That children's play tends to be differentiated along sex typed lines in the preschool years is of considerable concern. Play provides children "with an excellent opportunity to try combinations of behavior that would under functional pressure never be tried" (Bruner, 1976, p. 38). If different play activities impose different information processing demands, then sex typing of play preferences and playstyle has implications for cognitive and social development, and may affect future interests and career aspirations. For children to embark upon their future roles as productive, fulfilled and self respecting members of society they need to develop in an environment unburdened by prescribed societal limitations.

The differentiation of children's play according to notions of perceived sex appropriateness leads to the question of whether computers and styles of participation in computer based learning in preschool classrooms will be similarly sex typed. Does

the behaviour of children as young as four years of age in a computer active preschool classroom reflect the view that computers in society at large seem to be essentially a province of male domination? If interest and involvement with computers is sex typed at this early age, then what are the implications for policy makers and day to day teaching practice?

The findings from the handful of studies that explore gender related issues and computer use in preschools are sketchy. While some studies have reported no apparent differences in girls' and boys' use of the computer (Sherman et al., 1985; Muller and Perlmutter, 1985), others suggest that girls and boys do see and use computers differently (Beeson and Williams, 1985; Elliott, 1987; Swigger, Campbell and Swigger, 1983; Tan, 1985). Klinzing (1985) found that four year old males were "captivated by the computer" and used it significantly more than did four year old girls. Anecdotal evidence from this study indicated that the boys moved quickly to the computer area at the beginning of the free play period. Later when the computer was free the girls were busily engaged in other activities, particularly housekeeping and did not seem to want to abandon this to go to the computer area. Bolton-Lewis (1985) reported that the girls in her study who didn't use the computer claimed that the "boys wouldn't let them near it".

If, as some studies seem to be indicating, girls and boys in preschools seem to have different computing experiences, then teachers and policy makers must take action to foster more equitable participation in computer based learning. Because computers are only just being introduced to preschools it should be possible to create computer areas which are interesting and challenging for both girls and boys and to implement classroom management strategies which encourage all children to obtain the maximum benefit from developmentally appropriate computer based learning activities. Clearly this is an area that warrants further investigation.

The information about sex differences in children's behaviour presented in this report was obtained from an investigation of some issues relating to the use of computers in Australian preschool classrooms. The major aim of the study was to explore young children's behaviours while participating in developmentally appropriate computer based activities in preschool settings and to make recommendations to early childhood educators on matters of policy and curriculum. Because issues relating to gender and equity are of concern to early childhood educators, an important part of the study was to compare aspects of the behaviours of girls and boys in the computer area. However,

the findings on sex differences reported here represent only one dimension of the study.

Subjects and Method

The subjects of the study were 90 four year old children enrolled in four Sydney preschool classes who attended preschool for two or three sessions each week. Children were from middle to upper-middle class socio-economic backgrounds and representative of several ethnic groups. Amongst the range of background material gained before the computer was introduced to the children was information on their knowledge of computers, as well as their previous experience with computers. Children were also asked to rate their interest in a number of typical preschool play activities, as well as the computer.

In this study the computer was set up in a "learning centre" and available to the children during the "free play session" each morning. Children could choose to work in the computer area just as they would choose to work in any other learning centre. After a period of familiarity with the computer their behaviours were observed and recorded as they used two developmentally appropriate activities: a drawing program and a single key stroke version of Logo, with a floor turtle. The information presented in this paper relates to measures of:

- (1) computing knowledge, attitudes and experience,
- (2) expressed play preferences
- (3) frequency and duration of computer play and,
- (4) playstyle in the computer area.

Observations in each classroom took place over a five to six week period.

Results

(1) Children's computing knowledge, attitudes and experience

A semi structured questionnaire designed to probe children's computing knowledge, attitudes and experiences was administered prior to the introduction of the computer to the classroom. A preliminary investigation of results suggests that boys were more knowledgeable about computers than were girls and had more "hands on" experiences with them than did girls.

More boys than girls claimed to have seen a computer. Only 28.5% of boys as

opposed to 37.5% of girls had not seen a computer ($p \leq .0005$). Some 20% of children included in the study had a computer at home and there was no significant sex difference in this respect.

Some 70% of boys and 30% of girls claimed to have used a computer prior to the commencement of the study. They used computers in various places including their parents' place of work, (particularly father's work place), their own home, the homes of friends and relatives, and in stores with a computer sales section. Almost all boys (98%) and most girls (67%) were able to describe what a computer looked like in a way that was meaningful to the interviewer. When asked to draw a computer 90% of boys and 71% of girls drew a picture that clearly resembled a microcomputer. These differences in the responses for girls and boys were significant ($p \leq .0005$) in each instant. Interestingly, when children were asked whether they would like a computer in their classroom more girls than boys said "yes".

Three questions in the survey related to how a computer functioned. The scores for each were combined to give a total score for knowledge of what a computer was and how computer it functioned. An examination of all responses indicates that most children (78%) were able to provide some indication, in language appropriate to a four year old, of why people used computers or how a computer functioned. When girls' and boys' responses are examined in more detail it becomes clear that boys had a much better knowledge of the topic than did girls. They were able to give more detailed descriptions of computer operations and were more familiar with terminology relating to hardware and software.

One question in the survey asked children to decide whether girls or boys were best at using computers or whether they were both equally good. About half (54%) of the girls agreed that girls and boys were equally good at using computers, while only 38% of the boys agreed that girls and boys were equal in this respect. About a third of the girls felt that girls were best at using computers, while 60% of the boys believed that boys were best at using computers. Clearly boys were biased toward members of their own sex and felt strongly about their superiority.

Another question probed children's beliefs about adult expertise in computer use. Children were asked whether mummys or daddys were best at using computers, or whether they were both equally good. Some 17% of boys and 35% of girls believed that mummys and daddys were equally able and skilled at using computers. Only a few

children, 7% of boys and 8% of girls felt that mummys were best at using computers. Most children, 50% of girls and 64% of boys felt that daddys were best at using computers.

These results suggest that overall boys tended to be more knowledgeable about computers than did girls and were more likely to have seen and used a computer at some time or the other. Given the young age of the children these findings are of interest and perhaps concern. Why is it that boys seem to have had more opportunities than have girls to see and use computers? Have they in fact had the same opportunities but responded in different ways? Have girls seen computers and simply not remembered the event? Given their keen interest to have a computer in the classroom suggests that girls feel positive about computers and would welcome the opportunity to play with them if available.

That boys found computers to be more appropriate for males, whether they be "daddys" or children is not surprising. According to Smithers and Smithers (1984) young children tend to acquire a stereotyped and exaggerated view of what is appropriate for the sexes, but boys tend to differentiate appropriateness of activities on the basis of sex more than do girls. In addition, the reality for many of the young children in this study, is that they know of or see their fathers using computers at work, yet see mothers at home because they have young children in their care. As well, important mediators of children's beliefs are the broader societal experiences to which they have been exposed where the image of computers, especially as portrayed in the media, is largely male oriented.

(2) Children's expressed play preferences

Children were asked to rank the major play areas/activities commonly found in preschool centres in order of preference on three different occasions during the study. Children were interviewed prior to the introduction of the computer, when the computer had been in the classroom for four weeks, and at the conclusion of the study. For the purpose of this study a computer play centre was also included amongst the more usual activities. The traditional activities were Home Corner (cooking, dolls etc), Outside Play (climbing, wheeled toys, sand pit etc), Puzzles, Art and craft (painting, pasting, collage etc), Books and writing, and Blocks (Lego, wooden blocks etc). Each play areas was represented in pictorial form on a card.

On each occasion that this test was administered, an examination of total responses indicates that children ranked the computer centre as the one in which they would most like to play. The ranking of the other activities varied from test to test.

A more detailed examination of the ranking however, reveals considerable differentiation in expressed preferences for particular play activities depending on children's sex. In respect of the computer, boys' initial interest in selecting it as their preferred choice of play activity was sustained on subsequent occasions when the survey was administered.

At the first testing girls rated the computer as their third preferred choice of activity. Their comparative lack of interest at this point seems to reflect the state of their existing knowledge of and experiences with computers, compared with that of boys. When asked to rate play preferences a second time, that is after the computer had been in the classroom some four weeks, girls ranked it as their first choice of play activity. By the time of the third survey the computer was still rated as a popular choice of activity, but now ranked in second place.

Table 1
Childrens' ranking of play activities

	Boys		Girls		Boys		Girls	
Home	7	1	7	2	7	1		
Outside	3	6	2	7	2	5		
Puzzles	5	4	6	5	4	6		
Art/craft	4	2	5	4	5	3		
Computer	1	3	1	1	1	2		
Books	6	5	4	6	6	4		
Blocks	2	7	3	3	3	7		

An examination of the table suggests that the rankings of more traditional play activities by girls and boys tended to be polarised along sex differentiated lines. Boys rated the Home/Doll area as their least favourite play area, while Blocks and Outside play were rated highly. Girls tended to be less definite in their choices, but nevertheless rated the Home area highly, while expressing less interest in playing Outside or with the Blocks.

These findings, like those in other studies of play choices, suggest that preschool aged girls and boys are interested in different types of play activities and that their preferences seem to be differentiated along sex typed lines. Interestingly, both girls and boys rated the computer area as a popular play area. For boys the computer was the number one choice on each occasion. Girls also gave the computer a high ranking on each occasion. That girls ranked the computer highly, together with their claims that they would very much like to have a computer in their classroom, suggests that they are not disinterested in computers per se. Perhaps their comparative lack of knowledge of computers is indeed a reflection of subtle social pressures to develop interests in more "gender appropriate" pursuits.

(3) Duration of computer play

Observations of children's playstyle in the computer area were made over a six week period during 10 free play sessions, each lasting approximately 90-120 minutes. Children's arrivals at and departures from the computer area were noted throughout the study. Most children (93%) were observed in the computer area. The amount of time spent in the computer corner by individual children varied up to a maximum of 270 minutes over the six week period. Boys spent significantly more time in the computer area than did girls. They also used the computer more often than did girls.

That boys spent more time in the computer area than did girls is consistent with findings in Klinzing's (1985) study. When in the computer area children tended to play in same sex groups. As Smith (1985) emphasised peers constitute powerful influences on sex typed behaviours in preschool settings. Groups of children of the same sex often exclude opposite sex peers from their activities, with same sex peers tending to reinforce each other both positively and negatively more than opposite sex peers (Fagot and Patterson, 1969). Smith (1985) reports that girls may act to exclude boys from traditional female areas and boys exclude girls from traditional male areas. If, as indicated in this study, children tended to view the computer area as a male domain and work largely in same sex groups, then it may be that an important factor inhibiting girls involvement with the computer was the overwhelming presence of boys in the computer area. As Bolton-Lewis (1985) found in her study, girls felt somewhat alienated from the computer area because of the presence of boys.

(4) Playstyle in the computer area

Playstyle was observed in one minute phases. Each phase was divided into four 15 second segments. Each one minute phase was part of a three minute observational cycle in which interactive exchanges and verbatim records of conversations were also recorded. The playstyle of each child present in the computer area in any observational cycle was recorded. So at any one time the playstyle of up to five children may have been the subject of observation and recording. The number of observations made was dependent on the amount of time a child spent in the computer corner.

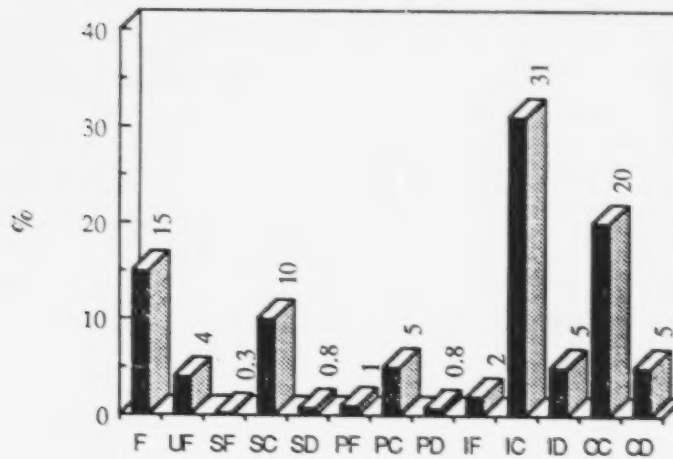
In all a total of 4631 episodes of play recorded in the computer corner were selected for analysis. Each episode was coded using the social-cognitive model of play complexity, that is in terms of both play type (focused, unfocused, functional, constructive, and dramatic) and the degree of social interaction (onlooker, solitary, parallel, interactive and cooperative). It was attempted, where ever possible, to include 60 recordings for analysis. In the case of children who were very frequent users of the computer area every second or third recording was selected for analysis. All recordings of playstyle were included in respect of those children who used the computer area less frequently.

The social-cognitive play complexity model denotes various cognitive levels of play within each social play category. This results in the identification of a number of play categories: solitary-functional (SF), solitary-constructive (SC), solitary dramatic (SD), parallel-functional (PF), parallel-constructive (PF), parallel-dramatic (PD), interactive-functional (IF), interactive-constructive (IC), interactive-dramatic (ID), cooperative-constructive (CC), and cooperative-dramatic (CD). Two other categories, onlooking-focused (F) and unfocused (UF) were also included.

Figure 1 indicates the number of episodes in each playstyle categorization as a percentage of total play episodes.

Figure 1

Play episodes in each playstyle categorization



Onlooking-Focused Onlooking-Focused behaviour accounted for 15% of all behaviours observed in the computer area. Despite the fact that the computer was in use for some time before observations were made it still aroused considerable interest amongst the children. There were often children watching others use the computer. Sometimes they watched out of general interest in the activity, or perhaps because of the novelty value of the computer, while at other times they were clearly waiting for a turn. Girls were more likely than boys to engage in onlooking-focused behaviours in the computer corner ($p < .001$).

Unfocused Included in the 4% of behaviours categorized under this heading were episodes of behaviour that occurred in the computer corner but were unrelated to the computer based task, for example, gazing into space. While boys engaged in slightly more episodes of unfocused behaviour than did girls, the difference was insignificant.

Solitary Play Solitary play accounted for 11% of all play in the computer area. Most solitary play (10%) was constructive and boys were significantly more likely than were girls to engage in this type of play ($p \leq .001$). There were only isolated instances of Solitary-Functional (.3%) and Solitary-Dramatic (.8%) play in the computer area. An example of Solitary-Functional play was when a child "punched" the computer keys or aggressively banged a block against the robot.

Parallel Play Episodes of parallel play accounted for 7% of all play behaviour observed in the computer area. Instances of Parallel-Functional and Parallel-Dramatic play accounted for nearly 2% of all play behaviours, while Parallel-Constructive play comprised 5% of all play episodes. As illustrated in Table 2 girls were more likely than boys to exhibit episodes of both constructive and dramatic play.

Interactive Play As illustrated in Figure 1 interactive play proved to be the most predominant style of play observed in the computer area, accounting for 38% of all play episodes. Most interactive play was categorized as constructive (31%). Some 5% of interactive play was of a dramatic nature. Again, an emergence of sex difference in respect of playstyle was noted. Table 2 indicates that girls were more likely than boys to engage in Interactive-Constructive play ($p \leq .001$), while boys were more likely than girls to engage in Interactive-Functional and Interactive-Dramatic play.

Cooperative Play As shown in Figure 1 a total of 25% of all recorded play episodes were categorized as cooperative play, with most cooperative play (20%) being of the constructive type. Table 2 reveals that boys were more likely than were girls to engage in both Cooperative-Constructive and Cooperative-Dramatic play.

Table 2 provides more detailed descriptive data on the occurrence of playstyle in the computer area.

Table 2
Mean episodes of playstyle for girls and boys

	boys	girls
F	6.7	8.4*
UF	2.1	1.9
SF	.2	.1
SC	6.4*	3.6
SD	.4	.4
PF	.6	.5
PC	1.6	3.4*
PD	.4	.5
IF	1.3*	.6
IC	14.2	17.5*
ID	4.2*	1.1
CC	11.1*	9.8
CD	4.2*	1.0

* $p \leq .001$

An important finding is that most play in the computer area was interactive or cooperative in nature. This supports other research which suggests that computer based learning activities in early childhood classrooms encourage social interaction (Clements, 1987). Klinzing (1985), in a study of preschoolers playstyle in computer active classrooms, found that 38% of all cooperative play exhibited by children in the classroom occurred in the computer area.

The finding though, that the play of girls and boys was different in a number of dimensions of playstyle is of concern. However, the areas in which differences occurred seem to mirror those reported in studies of playstyle in more traditional play areas.

Overall girls engaged in considerably more onlooking-focused behaviours than did boys, that is girls spent more time than boys watching rather than participating in the action. On the other hand when in the computer area they were slightly less likely than were boys to engage in off task, irrelevant activities. The fact that girls were observed watching computer play significantly more often than were boys, suggests that in some instances they may have wanted to be actively involved in the activities but were reluctant to break into an existing group- a group that may well have been all male.

That finding that boys were more likely than girls to engage in solitary play is consistent with patterns of playstyle reported by Sponsellor, Jarworski and Potter (1979), in studies of traditional play areas. It must be stressed that solitary play, particularly solitary-constructive play is not necessarily immature play (Barnes, 1980; Moore, Everson and Brophy, 1974). In this study, the boys who played at the computer alone often played with other children as well. In fact they tended to be frequent and competent computer users.

Only a small proportion of play (7%) was categorized as parallel and of this Parallel-Constructive play comprised 5% of all play episodes. As found by Rubin, Watson and Jambor (1978) in their study of more traditional classrooms, girls were significantly more likely than were boys to exhibit instances of parallel-constructive play.

Given the nature of the software it was not unexpected to find that most play (63%) was interactive or cooperative, that is, children played with others in the computer area.

Most interactive play was constructive (31%) and girls were more likely than boys to engage in this type of play. Boys were more likely than girls to engage in Interactive-Dramatic and Cooperative-Dramatic play. That boys engaged in more dramatic play is consistent with findings from studies of traditional play settings (Rubin, Maioni, and Hornung, 1976; Johnson and Ershler, 1981, Pellegrini, 1983). In this study much of the dramatic play whether it be interactive or cooperative focused on superhero and space/robot/war type themes. Even when using the drawing program groups of boys were able to think of ways in which cars and planes could crash into one another and rockets explode. Could it be that boys expected play at the computer to be of this nature because of the predominance of this type of theme in arcade type software? When girls were using the drawing program they seemed to be more interested in exploring its capacities by making designs of various complexities. When using the robot they tended to concentrate on learning to control it adequately. Were boys because of their more frequent use of the computer and hence familiarity with the operation of the software, able to focus less on the technology and more on the development of fantasy themes? Or is it the case that the technology, with its perceived associations with science and traditionally male oriented pursuits, generates play in keeping with this orientation. That girls play tended to be more constructive may suggest that when using the computer for drawing they were using it as a tool in much the same way as they would use a pen or paint brush. If this is the case then their pattern of use seems realistic and appropriate.

That boys were significantly more likely than girls to engage in both Cooperative-Constructive and Cooperative-Dramatic play, which are considered to be more sophisticated playstyles, may be similarly related to an affinity with the computer and the content of the software that is in keeping with their interests in other areas.

In this study the question of whether the computer area is seen as a male domain becomes confounded with children's propensity to avoid cross sex play. In addition, activities involving the Logo and the turtle also involved blocks and other building materials. That is, the children built roads, tunnels, bridges and garages for the turtle. Because of this the computer area may have been seen to be associated with the traditionally male block area.

Conclusion

The area of preschoolers' use of appropriate computer based learning activities is largely unexplored. There is a dearth of sound research-based information on the cognitive and affective effects of different types and levels of computer use (Goodwin et al. 1987; Johnson, 1985, p. 304). There are only a handful of studies that focus on the relationship between gender and computing experiences at the preschool level.

The findings outlined above are derived from a preliminary descriptive analysis of data from a comprehensive study of children's behaviours in computer active classrooms. As such they present only an indication of trends. However, the emerging data relating to apparent gender differences in computer based learning experiences may be cause for concern and is certainly an area that warrants further research. Whatever the outcomes of the research though, it seems essential that teachers take action to ensure that children's attitudes toward computers and their participation and performance in computer tasks are not unnecessarily differentiated along sex stereotyped lines. Given the long history of girls' disadvantaged position in maths and science we cannot afford to be complacent about this issue.

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